Effects of Exposure to Aggressive Bumper Stickers on Driving Behavior

Senior Research Thesis

Presented in partial fulfillment of the requirements for graduation *with research distinction* in Speech and Hearing Science in the undergraduate colleges of The Ohio State University

by

Alayna C. Rowell

The Ohio State University

April 2017

Project Advisors: Dr. Janet Weisenberger, Department of Speech and Hearing Science;

Dr. Brad Bushman, School of Communication & Department of Psychology

Abstract

Aggressive driving behavior, as defined by the National Highway Traffic Safety Administration, has been directly connected to increases in vehicular accidents (Nhtsa.gov, n.d.). Aggressive driving behavior is often elicited when another vehicle performs an action that frustrates or impedes the driver. Unanswered questions center around what exactly causes aggressive driving and why it is prevalent in today's society. The present study investigates whether drivers exhibit more aggressive behaviors when exposed to aggressive content that is tied closely to other human actors in the scenario, when the other human actors in the scenario are of divergent values or beliefs, or whether the actions of these other individuals alone are sufficient to elicit aggressive responses from the driver. This question was addressed by placing bumper stickers with aggressive or divergent-value content on other vehicles in a driving simulation scenario that committed frustrating acts towards the driver. The bumper stickers specifically reflected either neutral content (e.g., Five Tops) or aggressive content (e.g., Cruel Attacks), or reflected in-group affiliation (e.g., Buckeyes) or out-group affiliation (e.g., Wolverines). Participants completed a pre-designed, frustrating course in a realistic motion-base driving simulator. Measures of driver behavior (speed, following distance, time off road), cognition (word completion), affect (aggressive mood), physical arousal (heart rate/blood pressure), and trait anger were collected for drivers exposed to neutral-content and in-group bumper stickers versus aggressive-content and out-group bumper stickers in the driving scenario. It was expected that the aggressive-content and out-group bumper stickers would elicit more aggression on all the measures when compared to the neutral-content and in-group bumper stickers. Results showed a significant effect of aggressive bumper stickers only on word completion. External stimuli had no significant effects on mood, physiology, or driving behavior. However, examination of pre-driving measures of trait anger showed that participants assigned to the neutral content group actually had significantly higher trait anger than those assigned to

the aggressive content group. This may have created a sort of “leveling” effect that would have reduced differences in performance across groups. This factor will be explored as a covariate when data collection is completed. Possible additional explanations for the lack of an effect on the other measures are discussed.

Acknowledgments

I would like to thank Dr. Janet Weisenberger, my advisor, for her incredibly steady guidance, wisdom and invaluable input throughout this process. I would also like to thank Dr. Brad Bushman, my co-advisor, for his unfailing support, enthusiasm and for his offerings of expansive knowledge on this research topic. Another huge thank you is owed to the entirety of the Driving Simulation Lab team, with special mention to Dr. Thomas Kerwin, Anna Javins, and Allyson Boone for their considerable contributions to the running of participants and data analysis for this study. This work was presented at the Ohio State Denman Undergraduate Research Forum, and received a first place award in its category. The present study was supported by a Social and Behavioral Sciences Undergraduate Research Grant, as well as a College of Arts and Sciences Research Scholarship.

Table of Contents

Abstract……2

Acknowledgments……4

Table of Contents……5

Chapter 1: Introduction……6

Chapter 2: Method……14

Chapter 3: Results & Discussion……18

Chapter 4: Conclusion……29

References……31

Chapter 1: Introduction

When people observe chronic aggression in their environment, it can turn into expressed aggressive behavior in their everyday activities, a phenomenon observed in animals as well. In a 2010 study, Suzuki and Lucas found that 72 young male rats who passively observed ten minutes of aggression (two other male rats fighting over territory) each day for a month were significantly more likely to exhibit aggression themselves during that period compared to their control counterparts and compared to rats who observed one acute instance of the same aggressive behavior. The rats who observed aggression chronically even continued to exhibit aggressive behaviors for an additional sixteen days after the observations ceased. This suggested a learning effect of aggressive behavior, rather than a simple mimicry effect. These findings paralleled other, older studies that investigated human children (Bandura, Ross, & Ross, 1961; Guerra, Huesmann, & Spindler, 2003; Huesmann & Kirwil, 2007).

Humans can observe aggression in a number of situations throughout any given day, and an everyday task where aggressive behaviors can be observed in humans is driving. It is important that society address problems such as aggressive driving because the results from Suzuki and Lucas (2010) suggest that aggression on the road will only continue to increase as more and more drivers observe and engage in it every day.

Aggressive driving is cited by the National Highway Traffic Safety Administration as an increasingly common cause for traffic accidents in the United States (Nhtsa.gov, n.d.). Aggressive driving is defined as any combination of behaviors, which involve moving traffic violations, with the intent of damaging other people or property (Nhtsa.gov, n.d.). In Ohio alone, the year 2015 saw an increase in crashes with a total of 302,307 (Kasich & Born, 2016). Of these, 32.4% of fatal crashes were attributed to what can be defined as aggressive driving behavior, including improper lane changes/off road driving, excessive or unsafe speeds, and unsafe following distances (Kasich & Born, 2016; Nhtsa.gov, n.d.).

There is substantial literature on aggression and aggressive driving, but no clear consensus on why the behavior is so prevalent. Both internal and external triggers have been investigated, as well as the effect aggression may have on thoughts, mood, and physiological measures, as described by a General Aggression Model proposed by Anderson and Bushman in 2002. Some internal factors have been found to predict aggressive behavior, while some seem to be simply correlative, and still others yield inconclusive results. Examples of internal factors discussed in the literature include trait anger, narcissism, territoriality, anonymity, and group mentality. Some external factors have also been correlated with aggressive behavior, such as congested, urban environments, listening to aggressive lyrics of a song, reading aggressive words, and exposure to other various aggressive stimuli.

Internal Factors

Trait anger, defined as a stable personal factor, has been tested as an internal factor that predicts aggressive driving, but some studies have yielded mixed results and are therefore inconclusive (Britt & Garrity, 2006; Ellison-Potter, Bell, & Deffenbacher, 2001). In the study by Britt and Garrity in 2006, trait anger and various personality measures were investigated in correlation with anger and aggressive behavior in driving situations. 164 undergraduate students were asked to think back to three different instances of other drivers acting in specific aggressive ways toward them, and then completed self-reports on how they felt and reacted to these situations. They also completed anger/personality surveys. In this study, trait anger was correlated with high angry mood and aggressive behavior for these situations.

In the study by Ellison-Potter, Bell, and Deffenbacher in 2001, trait anger, aggressive stimuli, and anonymity were investigated in 289 students in an introductory psychology course. The internal perception of anonymity is perceiving oneself to be unrecognizable to potential peers, victims or onlookers. Participants took a driving anger scale, which is a self-report of how angry one would be if a certain described scenario happened; this served as the trait anger measure. The participants then had to ‘drive’ a scenario on a 17-inch computer screen, which

served as a low cost simulator. Anonymity conditions were simply imagined by the participant. Aggressive driving behavior was defined as speed, running red lights, collisions, and striking stick figure pedestrians. Results showed that anonymity had the largest effect on aggressive driving behavior, while driving trait anger had no significant effect.

Narcissism - an inflated view of oneself - (Lustman, Wiesenthal, & Flett, 2010; Martinez et al, 2008; Stucke & Sporer, 2002; Whitlock, 2016) and territoriality – perceiving oneself to own the road - (Szlemko et al, 2008) have both shown to be reliable correlates with high driver aggression. While narcissism has been thoroughly investigated, territoriality measures could be investigated more in depth. In the study by Szlemko et al (2008), bumper stickers on the driver's car were investigated as a token of driver territoriality on the road. A self-report battery of surveys were completed by 178 university students, with questions covering topics of attachment to the car they drove, value and condition of their vehicle, self-reported tendencies on driving aggression and general aggression, and presence of 'territory markers' (bumpers stickers and window decals). Results indicated that territory markers reliably predicted driver aggression and driver attachment to the vehicle.

Some literature, apart from aggressive driving, also speaks of 'group mentality' in the context of committing crimes (Amann, 2002) or in the context of mental health (Sani et al, 2010). Group mentality is the idea that a group of people, with shared values and core similarities, will be closer than if the group had many differing values (Sani et al, 2010). For example, genocide is distinguished because of the idea of 'group mentality'; victims are chosen solely because they are believed to be members of a certain distinctive group (Amann, 2002). In the investigation by Sani et al in 2010, measures were a battery of surveys, all self-reporting, that addressed mental health/stress and job/life satisfaction, perceived prestige within society, and in-group identification. Results showed that perceived 'in group status' correlates with better mental health. A question then arises: if 'in-group status' means a happier individual, would being surrounded by 'out-group' individuals increase the likelihood of a negative internal state

instead?

Research has not investigated whether there is an effect of group mentality, in reference to social groups based on such things as political or sports team affiliations, on aggressive behavior. This possibility of mindset, combined with the anonymity of drivers and other internal personality factors, could indeed be a recipe for aggressive driving - although it has not been directly investigated. Even so, internal triggers may not be the only factors causing aggressive behavior; often, an external trigger is also present.

External Factors

Among external triggers, congested, urban driving environments have been cited as eliciting more driver aggression (Cackowski & Nasar, 2003). 106 participants viewed one of three videos of highways with varying ratios of vegetation to man-made structures. Measures of state-trait anger (survey) and frustration tolerance exercises (time spent on unsolvable anagrams) were done before and after viewing the video. Participants who viewed the videos with more vegetation had higher frustration tolerance.

Exposure to aggressive stimuli, another external trigger, has been shown to elicit aggression in drivers (Ellison-Potter, Bell & Deffenbacher, 2001; Turner, Layton & Simmons, 1975). More specifically, aggressive words could have a ‘priming effect’ on aggressive behavior, thoughts or feelings (Bargh, Chen, & Burrows, 1996). In the same study by Ellison-Potter, Bell, and Deffenbacher (2001) that looked at trait anger and anonymity, the effects of aggressive stimuli (aggressive words and phrases on billboards, banners and other signs on the computer screen during the simulation) on driving behavior were also investigated. Aggressive stimuli were found to exert a modest effect on driver behavior.

In a study by Bargh, Chen, and Burrows (1996), rude behavior was primed (increased) when participants were exposed to a scrambled sentence test. Thirty-four students in an introductory psychology course were asked to make a sentence out of scrambled words. One group in the study was exposed to aggressive or rude words in the scrambled sentences. Then

the experimenter talked to the participant for 10 minutes. Measures were the number of times the participant interrupted and the duration of interruptions while the experimenter was speaking. A significantly larger percentage of people who were primed by rude stimuli ended up interrupting the experimenter. Results supported the idea that exposure to aggressive words could lead to aggressive behavior.

Turner, Layton, and Simmons (1975) investigated aggressive stimuli in the form of bumper stickers and weapons. They studied the effect of aggressive bumper stickers and visibility of a weapon (on a truck, directly in front of the participant, who remained stationary once the light turned green) on horn honking (used as a measure of aggression from the driver) in a naturalistic setting with 200 citizen drivers. Latency before beginning of honking, frequency of honks, and duration of honks were recorded. Results showed that male drivers who owned newer vehicles and who could not identify the other driver honked more when both the weapon and the aggressive bumper sticker were present.

In the same vein, William Szlemko and colleagues published work in 2008 finding that drivers with multiple bumper stickers and long-term familiarity with a vehicle reported that they were much more likely to drive aggressively, exhibiting territorial tendencies on the road, compared to drivers without bumper stickers and less attachment to the car they drove. This produces the suggestion that the bumper stickers on a vehicle are closely tied to the driver's identity, values, and sense of self.

The General Aggression Model

Anderson and Bushman (2002) proposed a General Aggression Model explaining how personal (internal) and situational (external) factors can influence aggressive behavior through the routes of cognition (thoughts), emotional affect (feelings/mood) and/or physiological state (heart rate or blood pressure). All 3 routes are heavily interconnected and influence each other. In other words, an input variable such as an aggressive bumper sticker (situational) or trait anger (personal) can influence or predispose an individual to aggressive behavior through the

'present internal state' that they create (any combination of cognition/thought processes, emotional affect/mood, and arousal). A schematic showing the relationships between these factors can be seen in Figure 1. Anderson and Bushman (2002) stated that an "as yet untested, possibility is that unusually high and low levels of arousal may be aversive states, and may therefore stimulate aggression in the same way as other aversive or painful stimuli."

However, a study was conducted, using this model, to investigate the effect of violent lyrics on cognition and affect (Anderson, Carnagey, & Eubanks, 2003). A collection of 5 experiments were conducted, and procedures consisted of varying surveys looking at trait and state hostility, cognition, and emotional affect before and after listening to either a violent-lyric or nonviolent-lyric song. Results showed that songs with violent lyrics, controlled for music style, artist, and level of arousal, increased aggressive cognition and affect (Anderson, Carnagey, & Eubanks, 2003). This study did not, however, study signs of aggressive behavior beyond these measures. Examining the General Aggression Model (Anderson & Bushman, 2002) while also examining behavior would directly address the relationship cognition, affect or physical arousal have as routes toward aggressive behavior.

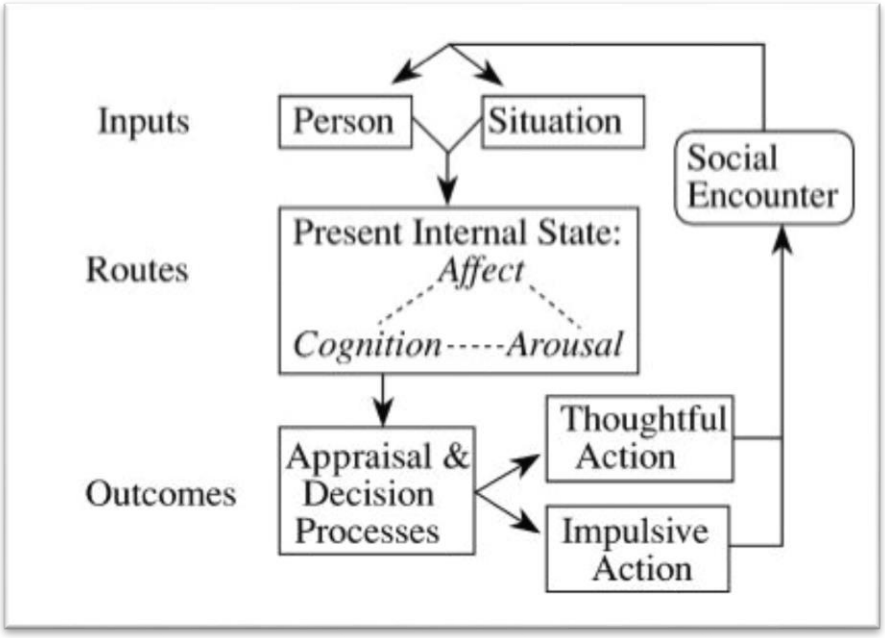

Figure 1. General Aggression Model (Anderson & Bushman, 2002).

The Present Study

Some additional limitations of the described studies involve the use of a singular administration of self-report measures instead of directly observing behavior (Szlemko et al, 2008); the recording of single instances of horn-honking as the aggressive driving measure (Turner, Layton, & Simmons, 1975); and the use of unrealistic, non-immersive simulator equipment (Ellison-Potter, Bell, & Deffenbacher, 2001) . Very few studies have looked at group mentality correlations with aggressive driving behavior, or at measures of heart rate or blood pressure as they relate to aggressive driving.

It is expected that vehicles that behave in ways that frustrate other drivers (e.g., cutting the driver off, driving too slowly) might elicit aggressive responses. However, it is unclear whether aggressive wording or out-group affiliations tied to the vehicles that commit frustrating acts would elicit more aggression from a driver. The present study addresses this question by measuring the trait anger, cognition, affect and physical arousal of drivers, as well as their aggressive behaviors, when they encounter neutral-content bumper stickers and aggressive-content bumper stickers on other cars committing frustrating acts in a pre-designed scenario.

In the present study, nineteen participants recruited from the Ohio State University C-REP pool drove a frustrating scenario in a motion-base driving simulator. Frustrating acts (e.g., cutting off the driver) were exhibited by other cars in the scenario. Bumper stickers were placed on these other vehicles, utilizing a between-group design, reflecting either neutral content (e.g., Five Tops) or aggressive content (e.g., Cruel Attacks), or reflecting in-group affiliation (e.g., Buckeyes) or out-group affiliation (e.g., Wolverines). Measures of driver behavior (velocity, following distance, off road driving) were collected from drivers in both groups. Video and audio recordings of drivers in the simulation were used to track these behaviors. Measures of aggressive driving were based on safety criteria defined by The National Highway Traffic Safety Administration (Nhtsa.gov, n.d.). The additional measures, including trait anger, cognition

(thoughts), affect (feelings/mood), and physical arousal (heart rate/blood pressure), were obtained before and/or after the driving simulation.

The hypothesis for the present study is that aggressive-content bumper stickers would elicit more aggressive driving behaviors, a greater increase in physical arousal and more agitated affect and cognition of the drivers compared to the neutral-content bumper stickers. Such a result could reflect the driver attributing the aggressive-content bumper sticker to the individual driving that car, and in turn produce a more profound effect on measures of internal aggression compared to the situation where the scenario is just generally frustrating. Results were anticipated to address the question of additivity in the external factors that can lead to aggressive behavior, with direct implications for the applicability of the General Aggression Model to aggressive driving.

Chapter 2: Method

Participants

The present study received approval from the Ohio State University Institutional Review Board (IRB Protocol 2014B0200, PI Brad Bushman). Thirty-one participants (from an expected total of 40) were tested. Twenty-two of these (17 men, 5 women) completed testing (others experienced simulator sickness and did not complete the testing). These were communications-major college students from the research participation class pool (CREP), who were randomly assigned to one of two groups: neutral-content, in-group bumper stickers (9 participants) or aggressive-content, out-group bumper stickers (13 participants). Participants drove a 30-minute simulation pre-programmed with numerous frustrating events (e.g., traffic jams, cars cutting off the driver) in a six degree-of-freedom motion base driving simulator. This simulator is shown in Figure 2. Participants were not initially informed that the study was about aggressive driving, but were debriefed after completing the study.

Figure 2. Driving Simulator.

Simulator Equipment and Scenario

The present study used a Realtime Technologies Inc. (RTI) simulator with a 2010 Honda Accord cab mounted on a 6-DOF motion-base platform. The vehicle interior has a gas pedal, brake pedal, shifter knob, turning signal, a dashboard screen, and a steering wheel. Five projectors display portions of the scenario on a cylindrical projection screen around the vehicle, providing a 260° field of view, with software "knitting" to create a seamless visual field. There is also a rear projection screen for the participant's rearview mirror; an LCD display is integrated for each of the side mirrors. Four cameras are mounted in the interior of the vehicle, to capture both the participant and the simulated scenario. Two external audio speakers are mounted to the cylindrical screen to provide audio cues about the vehicle's motion (engine noise, wind noise, passing vehicles, etc.).

The simulation was created with SimCreator (RTI) scenario creation software. The scenario imitated a four-lane highway (two lanes per direction of traffic) with a relatively high level of traffic. Frustrating events were programmed at specific times and involved two mimic cars, a pull-out car, and a traffic jam. All cars committing the frustrating acts had bumper stickers attached. In addition to the cars involved in these events, there were also neutral cars programmed to follow the flow of traffic and obey the laws of the road, and some of these cars had neutral bumper stickers on them as well.

Simulation Elements

Mimic Cars

Two mimic cars were programmed to speed ahead of the driver and swerve into the driver's lane to cut them off. The mimic car then continued to move in front of the driver every time a lane change was attempted, prohibiting the driver from passing the mimic car. Each mimic car was programmed to carry out this behavior for 7,200 meters. The first mimic car had a political bumper sticker, and the last mimic car had a sports bumper sticker. An example of a bumper sticker can be seen in Figure 3.

Pull-Out Car

A pull-out car was programmed to pull out in front of the driver from a side street at an intersection when the driver had the right-of-way. The pull-out car had an aggressively or neutrally worded bumper sticker.

Traffic Jam

A traffic jam was programmed to have two cars drive at the same speed and slow down dramatically, each of them taking up one of the two available lanes. This forced the driver to slow down as well, as it was impossible for the driver to legally pass them. The traffic jam lasted for 3,600 meters. The cars that caused the traffic jam had mixed bumper stickers.

Figure 3. Scenario vehicle with bumper sticker/decal.

Procedure

First, participants completed a battery of surveys for all studies in the CREP pool. All CREP students had to complete this battery before they could enroll in any of the studies. Included in the battery was a trait anger questionnaire, questions verifying the participants' political and sports team affiliations, and questions verifying their degree of engagement/interest

in these topics. Upon arrival at the lab, participant consent was obtained and a pre-drive recording of heart rate and blood pressure (systolic and diastolic) was measured using BioPac physiological monitoring equipment. The participants were then introduced to the driving simulator and informed of its operation. During the time that the participant drove the simulator, the moderator was in the control room, monitoring the equipment and assisting the participant as needed through an intercom system. The moderator followed a script, and told participants that other cars in the scenario may be controlled by other students, and said the study was looking at the simulator function as well as how efficiently people adapted to it. Participants were asked to imagine they were running late to a job interview, so they would want to complete the scenario as quickly as possible. A 5-minute practice drive in the simulator was completed to allow the participant to become comfortable with the style of driving and characteristics of operating the simulator. The 20-minute experimental drive in a frustrating scenario came next, followed by a post-drive recording of heart rate and blood pressure and completion of cognition and mood surveys. Cognition was measured by a word completion test, in which participants were asked to fill in the letters missing from a word. The mood survey was a series of statements for which participants were asked to rate on a scale of 1-5 their level of agreement regarding their mood/feelings at the present time. Finally, the moderator debriefed the participant, informing them that the true nature of the experiment was to investigate aggressive driving behavior as influenced by bumper sticker content. Participants were reminded that they could withdraw their data from the study at this point.

Chapter 3: Results & Discussion

The following results are discussed as internal dependent variables, behavioral dependent variables, and other correlated factors. The independent variable was the neutral-content/in-group and aggressive-content/out-group bumper stickers in the scenario, and the dependent variables were the physiological measures, cognition (word completion), emotional affect (aggressive mood survey), following distance (2 sec), velocity and off road driving. A correlated factor was trait anger (survey).

Internal Dependent Variables

Blood Pressure

Systolic and diastolic blood pressure measures were obtained pre- and post-drive, and the differences per participants were analyzed for the neutral-content bumper sticker group versus the aggressive-content bumper sticker group. Figure 4 shows a graphical representation of the mean difference in pre/post systolic blood pressure for the two groups. There was very little difference in systolic blood pressure between the two groups, and the variability was great. ANOVA confirmed that there was no significant effect of bumper stickers on systolic blood pressure ($F(1,20)=0.000317$, $p=0.986$). Figure 5 shows a graphical representation of the mean difference in pre/post diastolic blood pressure for the two groups. Surprisingly, there was a larger increase in diastolic measurements for the neutral-treatment group, but ANOVA showed this to be insignificant ($F(1,20)=0.501$, $p=0.487$).

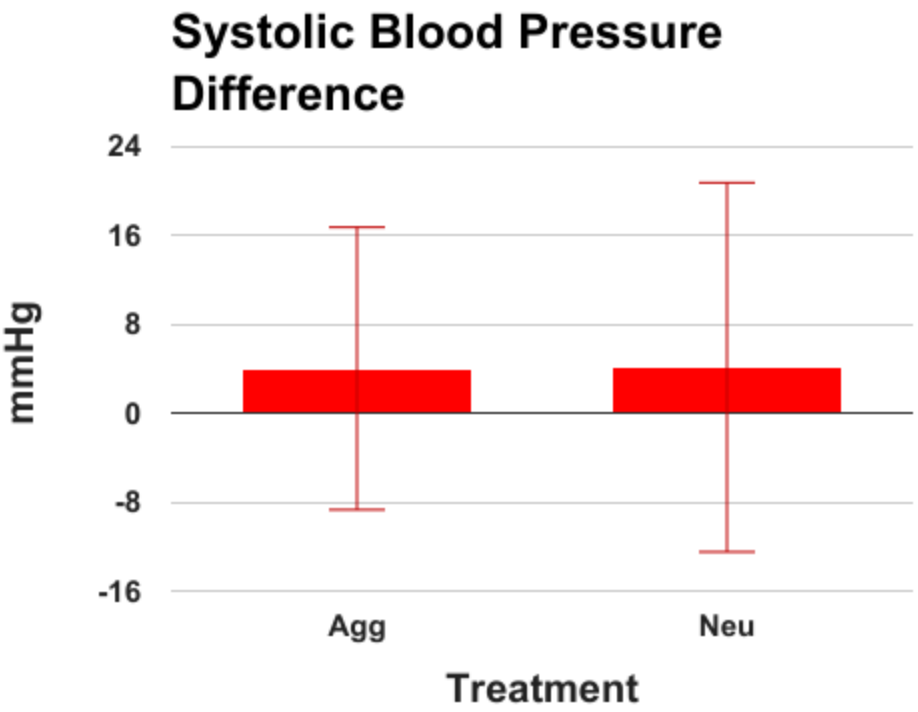

Figure 4. Pre/post drive difference in systolic blood pressure for aggressive-content and neutral-content groups.

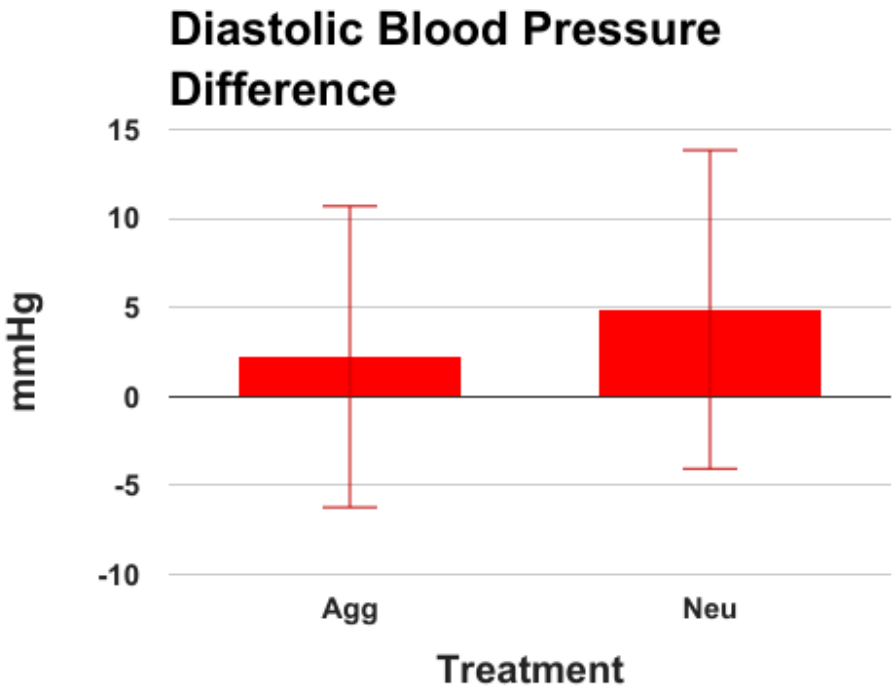

Figure 5. Pre/post drive differences in diastolic blood pressure for aggressive-content and neutral-content groups.

Heart Rate

Heart rate measures were obtained pre- and post-drive, and the differences per participants were analyzed for the neutral-content bumper sticker group versus the aggressive-content bumper sticker group. Figure 6 shows a graphical representation of the mean difference in pre/post heart rates for the two groups. Overall, both groups had decreased heart rate post-drive, but the neutral-treatment group had larger decreases. However, the variability was so great that confidence could not be taken in these results. ANOVA confirmed that there was no significant effect of bumper stickers on heart rate ($F(1,20)=0.0153$, $p=0.903$).

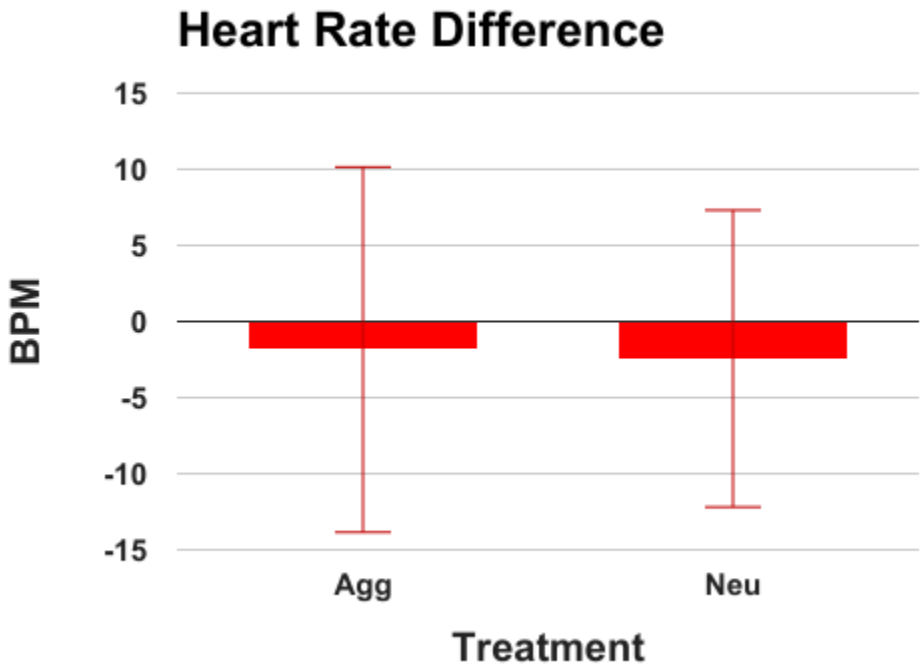

Figure 6. Pre/post drive difference in heart rate for aggressive-content and neutral-content groups.

Cognition

Measures of cognition were obtained post-drive, via a word completion task. Participants were asked to fill in missing letters of a word, and the possible words were deemed either neutral or aggressive. For example, “a_ _se” could either be completed

as “amuse” or “abuse”, among other possibilities. Scoring was based on how many aggressive words the participant filled in, and in Figure 7 the percentage of aggressive answers for the neutral-content bumper sticker group and the aggressive-content bumper sticker group can be viewed. The aggressive-treatment group answered the word completions with a higher percentage of aggressive terms, suggesting a slightly more aggressive cognitive state. ANOVA confirmed that there was a significant effect of bumper stickers on cognition ($F(1,20)=4.72$, $p=0.042$). This result supports previous findings in the literature reporting that exposure to aggressive content increases aggressive word responses (e.g., Anderson, Carnagey, & Eubanks, 2003).

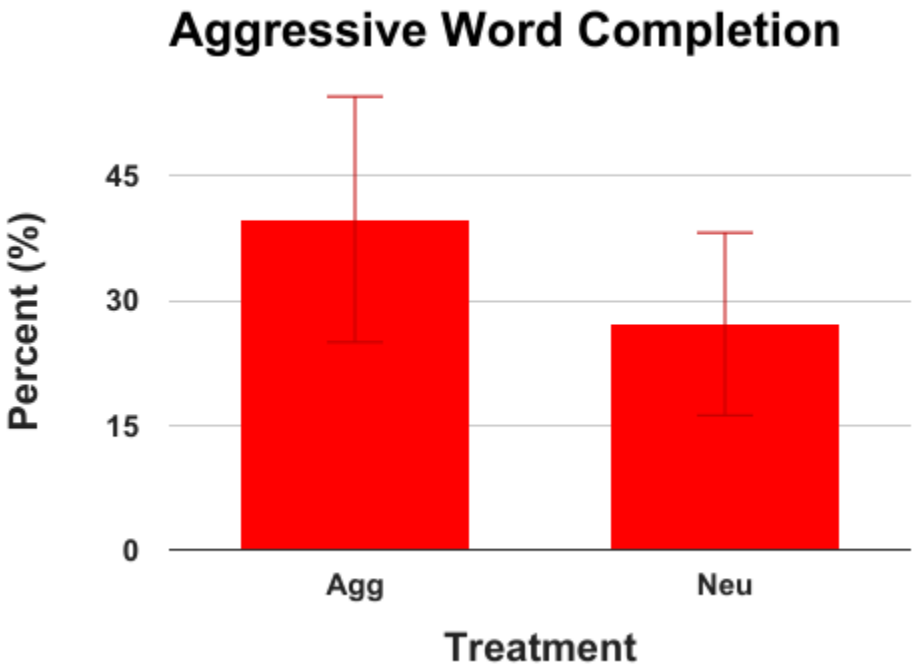

Figure 7. Percentage of aggressive word completions for the aggressive-content and neutral-content groups.

Affect

Measures of emotional affect were obtained through an aggressive mood survey administered to participants post-drive. The surveys were scored based on how aggressive the participants reported their mood to be. For example, the survey asked

the participant to rate on a scale of 1-5 (1 being ‘Not at all’ and 5 being ‘A lot’) how they felt in the present moment. The moods that they rated were all synonymous with anger, such as ‘peeved’ and ‘furious’. Figure 8 shows a graphical representation of the mean scores. Surprisingly, the neutral-treatment group answered with more aggressive moods than the aggressive-treatment group. However, the ANOVA indicated that there was no significant effect of bumper stickers on driver emotional affect ($F(1,20)=2.41$, $p=0.136$).

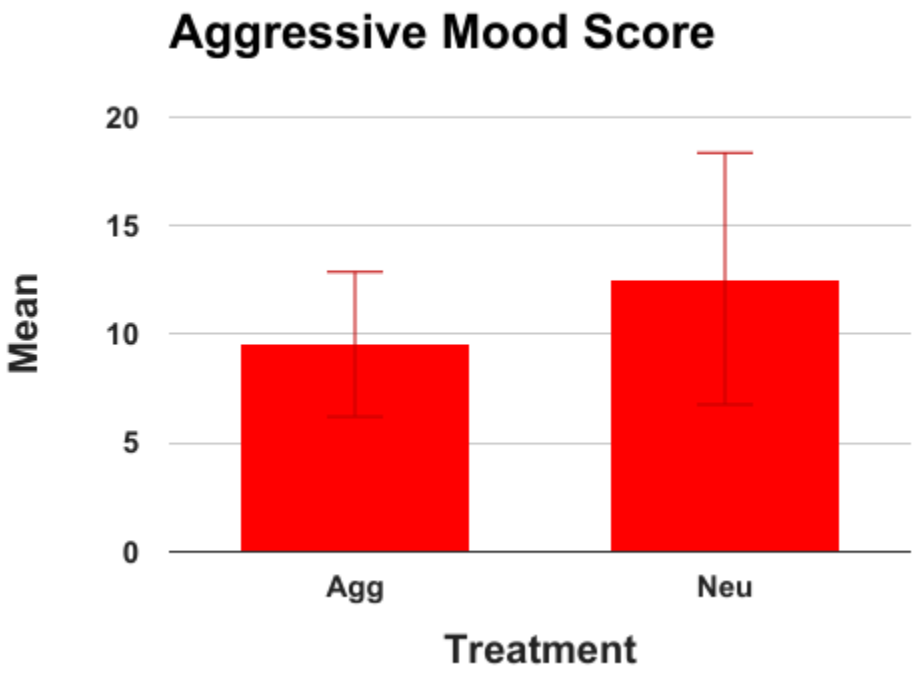

Figure 8. Scores on the aggressive mood survey for the aggressive-content and neutral-content groups.

Behavioral Dependent Variables

All of the following behavioral dependent variables were measured, via tracking software and the audio and video recordings during driving.

Following Distance (2 sec)

Measures of following distance within two seconds were obtained for each participant. Following distance within two seconds means that once the car in front of the driver passed a certain point, the driver passed that same point within a two-second

timeframe. This measure is deemed to be an unsafe following distance for the speeds at which participants drove (Nhtsa.gov, n.d.). The percentage of time each participant spent at an unsafe following distance was recorded and is shown, compared between the neutral-treatment group and the aggressive-treatment group, in Figure 9. Interestingly, both groups were similar, with the neutral-treatment group showing a slightly higher percentage of time spent at an unsafe following distance. However the ANOVA indicates that this difference is not significant ($F(1,20)=0.0308$, $p=0.862$).

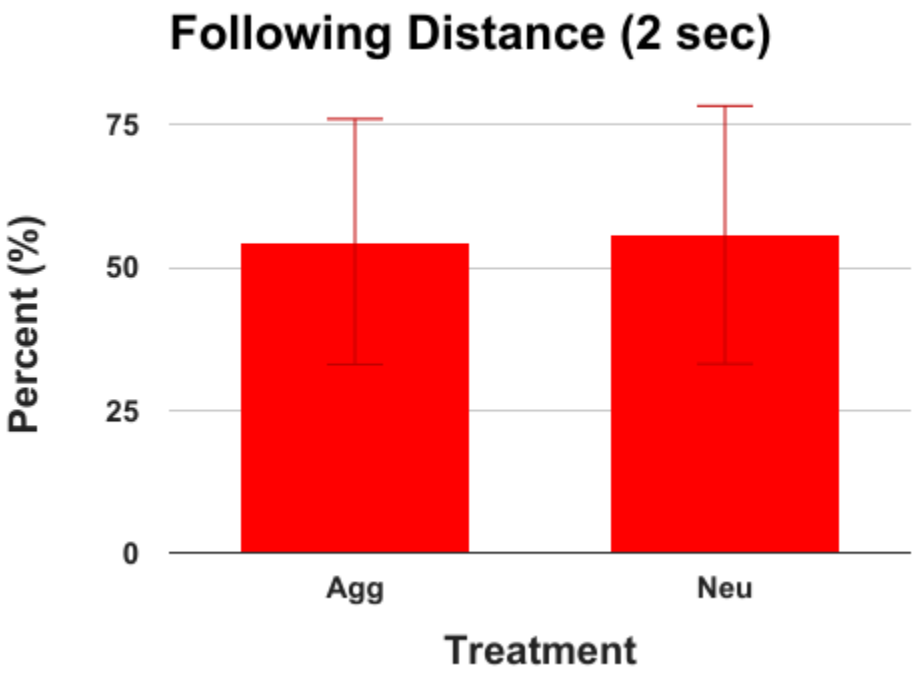

Figure 9. Percentage of time participants drove with following distances of 2 seconds or less, for the aggressive-content and neutral-content groups.

Velocity

Participant driving velocity was measured and the mean velocities are shown for the neutral-treatment group and the aggressive-treatment group in Figure 10. The aggressive-treatment group had a very slightly higher mean velocity; however the large variability lessens confidence in this difference. ANOVA confirmed that there was no significant effect of bumper stickers on speed ($F(1,20)=0.0393$, $p=0.845$).

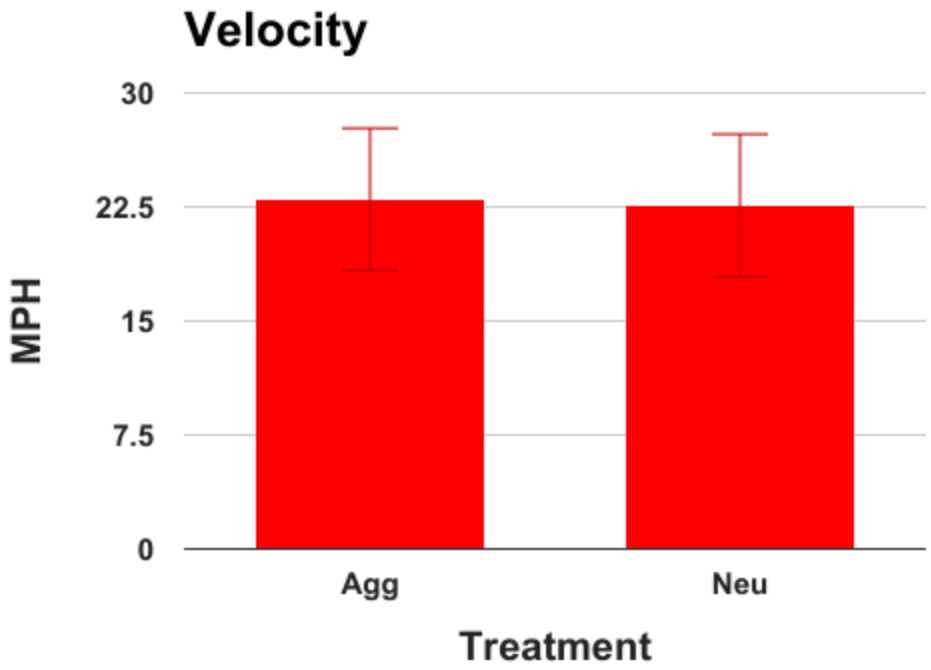

Figure 10. Mean driving velocity for the aggressive-content and neutral-content groups.

Off Road Driving

The time spent driving off the legal road was also recorded for each participant. This included passing over the yellow line (into oncoming traffic) and driving off the road (onto or past the shoulder). The results were compared between the neutral-content bumper sticker group and the aggressive-content bumper sticker group, as shown in Figure 11. The aggressive-treatment group had a higher time spent off road, but variability was also very high. ANOVA confirmed that the bumper stickers did not have a significant effect on time spent driving off the legal road ($F(1,20)=0.643$, $p=0.432$).

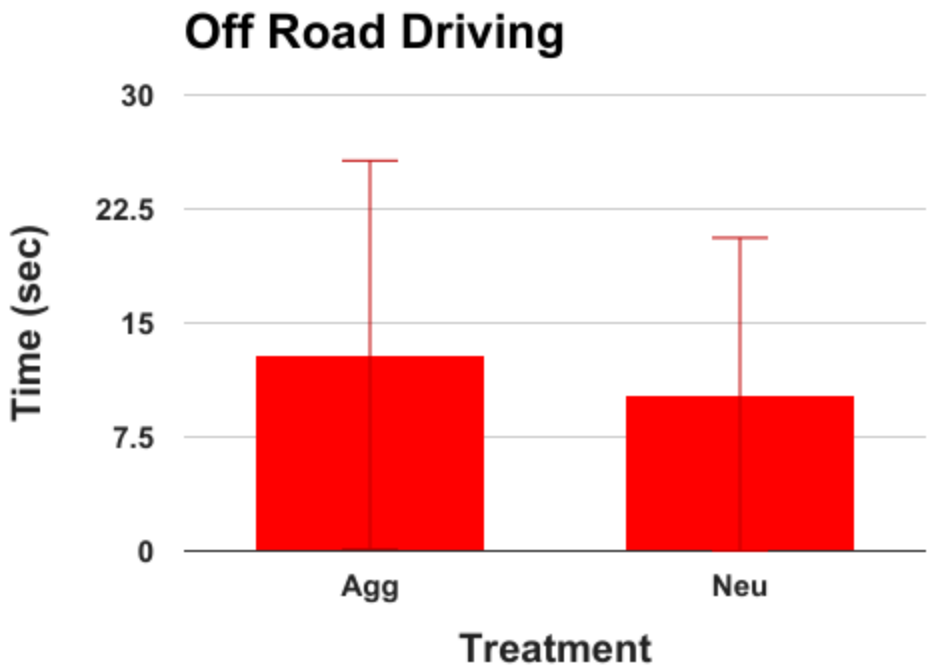

Figure 11. Time spent driving off road for the aggressive-content and neutral-content groups.

Correlated Factors

Trait Anger

The measure of trait anger was not a part of the hypothesis, but the survey was a part of the pre-screen that all participants in the CREP pool completed before enrolling in any studies. Trait anger is different from state anger, in that it is a more stable personality measure rather than a transient mood. Like most such measures, it is assumed to be normally distributed in the population. The present study analyzed the differences between groups on scores for the trait anger survey, to ensure that the two groups did not differ in trait anger a priori. Surprisingly, results showed a significant difference across groups, with the neutral content group exhibiting a higher level of trait anger ($F(1,20)=10.4$, $p=.00429$). If this difference persists in subsequent data collection, trait anger will be analyzed as a covariate in future analyses.

General Discussion

Contrary to the hypothesis, there was a significant impact of aggressive content bumper

stickers only on the word-completion test. No significant effects of the bumper sticker content on any of the other dependent variables were observed. Some analyses did suggest possible gender effects, which were evaluated separately from the hypothesis. Males tended to exhibit slightly higher instances of unsafe following distance. However, the number of women tested to date is extremely low, so more participants will be needed in order to determine any possible gender influences on the data.

The surprising finding that participants assigned to the neutral-content group actually had significantly higher trait anger scores makes it more difficult to evaluate the results of the present study. The trait anger scores were not examined prior to testing. Because participants were assigned randomly to the neutral-content or aggressive-content groups, this variable was not controlled for in the study design. However, it is possible that this difference in trait anger could have created a “leveling” effect that mitigated differences in performance on the dependent measures. It would be premature to assert that this was the case, until additional participants can be tested. But the finding is intriguing and should be carefully observed as testing progresses.

Multiple other factors in the present study could have impacted the results. Many of these include the participant population. Participants exhibited high no-show rates; this could indicate that the students did not take the experiment seriously. Further, students from the CREP pool participate in multiple studies, and may always be expecting “something” to occur in a given study. A number of informal statements from participants supported the idea that they expected some manipulation that was not revealed prior to their participation. Thus, they may be poor representations of a realistic general population.

Since the CREP pool consists of almost entirely a younger population, and the present study consisted of mostly males, one possibility is that the participants treated the simulation more like a videogame than a realistic scenario. Anecdotal observations by the moderator showed that some participants often laughed during the simulation, and reacted to the

frustrating cars in the scenario by simply driving through them (a safety feature built into the simulator). Past research suggests that some types of humor could mitigate aggressive tendencies (Prerost & Brewer, 1977). This could also be the source of confound for the present study. The combination of bored or disengaged participants who are not only expecting something to happen, but also know they are safe and have no other tasks, may have created an environment that led them to view frustrating aspects of the scenario with humor instead of aggression. In other words, when the mimic car would continuously swerve in front of them, these participants might have found this behavior humorous, which could have mitigated any effects of the bumper stickers.

Anecdotal findings from another study currently underway may suggest that the cognitive workload of the driver may have a relationship with the level of frustration that driver experiences. The study, carried out by a fellow undergraduate at Ohio State, uses the same driving simulator as the present study and aims to look at the effect of increased cognitive workload on situational awareness and driving behavior in the aging population as well as the hearing-impaired population (Javins, 2017). Participants in this study drove in a scenario extremely similar to the one in the present study and commented, of their own accord, that the experience was very frustrating. Anecdotal remarks were directed at other cars in the scenario.

Further, participants in the present study were not asked if they noticed the bumper stickers in the scenario, so it was never verified that they paid as much attention to the stickers as might have been anticipated. Another possible limitation involves motivation. Participants were asked to complete the simulation quickly, and to imagine that they were late to a job interview. This was done in an attempt to add a realistic urgency to the scenario. This may, however, have been insufficient motivation to make the scenario feel both realistic and urgent, as well as frustrating when paired with the programmed mimic cars, pull-out car, and traffic jam. Finally, the effects of the aggressive/neutral words and in-group/out-group bumper stickers may have interacted with each other in unexpected ways, muddling the results.

The lack of a greater number of significant effects, together with the trait anger group differences, makes it difficult to evaluate these results in the context of the General Aggression Model. A very small amount of aggression was seen in this study overall, and so a future study that addresses confounds and limitations of this study may be a better way to assess and use the General Aggression Model.

Future studies could employ many different tactics to improve upon the present study. Future studies could solicit a larger and more representative sample, including a more generalized population in age and background, and include a survey post-drive that verified driver attention to the bumper stickers, as well as driver engagement with the content of the bumper stickers. Future studies could also devise a different premise for motivating participants that would perhaps make the scenario feel more urgent and realistic. A future study should also separately assess possible effects of aggressively worded bumper stickers and out-group bumper stickers. Another option for future studies is to add more distractors to the scenario and increase the cognitive workload of the driver, which would possibly make the driving environment more frustrating and more realistic.

Chapter 4: Conclusion

The present study aimed to look at internal and behavioral reactions to aggression as affected by neutral-content or aggressive-content bumper stickers. The internal measures consisted of physiology, cognition and emotional affect as defined by the General Aggression Model. The behavioral measures were driving behaviors, consisting of following distance, velocity and off road driving.

The hypothesis for the present study was that aggressive-content bumper stickers would elicit more aggressive driving behaviors, increased blood pressure/heart rate and higher aggressive cognition and emotional affect compared to the neutral-content bumper stickers. Such a result could suggest some form of additivity in the stimuli that elicit aggression. ANOVAs were performed to test this hypothesis. Results indicated that participants exposed to aggressive content showed higher aggressive cognition post-drive as measured by the word completion test, but no significant increases were found in measures of aggressive driving behavior or affect, and no significant increases were found in blood pressure (systolic or diastolic) or heart rate compared to participants exposed to neutral content. Possible pre-test measures of trait anger, showing higher trait anger in the neutral-content group, may have impacted the results.

Many other factors could have confounded the results. Limitations include the narrow nature of the participant population, possible lack of attention to the bumper sticker stimuli, lack of motivation, and too light of a cognitive workload throughout the simulation. Ideas for future research that resolves these limitations have been discussed.

The need for future studies that address these confounds is clear to provide a better understanding of the factors that may or may not promote aggressive driving, so that the cause for so many traffic accidents throughout the United States can be pinpointed. Being able to directly address the catalysts to aggressive driving behavior is important because it could lessen

the occurrence of traffic accidents and as a result, lessen the financial burden that accidents have on drivers and the economy, as well as save lives. Although results are preliminary and further research is needed, the present study still sheds light on the factors that may or may not promote aggressive driving, with possible insights for training, intervention, or future studies that could mitigate these behaviors or clarify results. Knowing what does not influence aggressive driving is as helpful as knowing what does, when it comes to determining ways to keep the roads safer for everyone.

References

Amann, D. M. (2002). Group mentality, expressivism, and genocide. *International Criminal Law Review*, *2*(2), 93-143.

Anderson, C. A., & Bushman, B. J. (February 01, 2002). HUMAN AGGRESSION. *Annual Review of Psychology, 53,* 1.

Anderson, C. A., Carnagey, N. L., & Eubanks, J. (January 01, 2003). Exposure to violent media: the effects of songs with violent lyrics on aggressive thoughts and feelings. *Journal of Personality and Social Psychology*, 84, 5, 960-71.

Bandura, A., Ross, D., & Ross, S.A. 1961. Transmission of aggression through imitation of aggressive models. *Journal of Abnormal Social Psychology*, 63, 575-582.

Bargh, J. A., Chen, M., & Burrows, L. (1996). Automaticity of social behavior: Direct effects of trait construct and stereotype activation on action. *Journal of Personality and Social Psychology*, 71, 230–244.

Britt, T. W., & Garrity, M. J. (2006). Attributions and personality as predictors of the road rage response. *The British Journal of Social Psychology / The British Psychological Society*, 45(Pt 1), 127-147.

Cackowski, J. M., & Nasar, J. L. (November 01, 2003). The Restorative Effects of Roadside Vegetation: Implications for Automobile Driver Anger and Frustration. *Environment & Behavior, 35,* 6, 736-751.

Ellison-Potter, P., Bell, P., & Deffenbacher, J. (February 01, 2001). The Effects of Trait Driving Anger, Anonymity, and Aggressive Stimuli on Aggressive Driving Behavior. *Journal of Applied Social Psychology, 31,* 2, 431-443.

Guerra, N.G., Huesmann, L.R., & Spindler, A.J. 2003. Community violence exposure, social cognition and aggression among urban elementary-school children. *Child Development*, 74, 1561-1576.

Huesmann, L.R., & Kirwil, L. 2007. Why observing violence increases risk of violent behavior by the observer. The Cambridge Handbook of Violent Behavior and Aggression. New York: Cambridge University Press, pp 545-570.

Javins, A. (2017). *The impact of hearing impairment on cognitive workload, situational awareness, and driving behavior*. BA thesis. The Ohio State University, Columbus. Print.

Kasich, J., & Born, J. (2016). *2015CrashFacts* (1st ed., pp 6-7). Ohio Department of Public Safety. Retrieved from http://www.publicsafety.ohio.gov/links/2015CrashFacts.pdf

Lustman, M., Wiesenthal, D. L. and Flett, G. L. (2010), Narcissism and Aggressive Driving: Is an Inflated View of the Self a Road Hazard?. *Journal of Applied Social Psychology*, 40: 1423–1449. doi:10.1111/j.1559-1816.2010.00624.x

Martinez, M. A., Zeichner, A., Reidy, D. E., & Miller, J. D. (2008). Narcissism and displaced aggression: Effects of positive, negative, and delayed feedback. *Personality and Individual Differences, 44*(1), 140-149. doi:10.1016/j.paid.2007.07.012

Nhtsa.gov, *Aggressive Driving*. Retrieved 11 April 2017, from https://one.nhtsa.gov/Driving-Safety/Aggressive-Driving

Prerost, F. J., & Brewer, R. E. (December 01, 1977). Humor Content Preferences and the Relief of Experimentally Aroused Aggression. *The Journal of Social Psychology, 103,* 2, 225-231.

Sani, F., Magrin, M. E., Scrignaro, M., & McCollum, R. (January 01, 2010). In-group identification mediates the effects of subjective in-group status on mental health. *The British Journal of Social Psychology, 49,* 883-93.

Stucke, T. S. and Sporer, S. L. (2002), When a Grandiose Self-Image Is Threatened: Narcissism and Self-Concept Clarity as Predictors of Negative Emotions and Aggression Following Ego-Threat. *Journal of Personality*, 70: 509–532. doi:10.1111/1467-6494.05015

Suzuki, H., & Lucas, L. R. (January 01, 2010). Chronic passive exposure to aggression escalates aggressiveness of rat observers. *Aggressive Behavior, 36,* 1, 54-66.

S.W., J. B., J.A., B.P., A.D., J.L., & T.L. (June 01, 2008). Territorial Markings as a Predictor of Driver Aggression and Road Rage. *Journal of Applied Social Psychology, 38,* 6, 1664-1688.

Turner, C. W., Layton, J. F., & Simons, L. S. (1975). Naturalistic studies of aggressive behavior: Aggressive stimuli, victim visibility, and horn honking. *Journal of Personality and Social Psychology, 31*(6), 1098-1107. doi:10.1037/h0076960

Whitlock, T. (2016). *The Influence of Weapon and Alcohol Cues on Road-Rage in a Driving Simulator*. BA thesis. The Ohio State University, Columbus. Print.